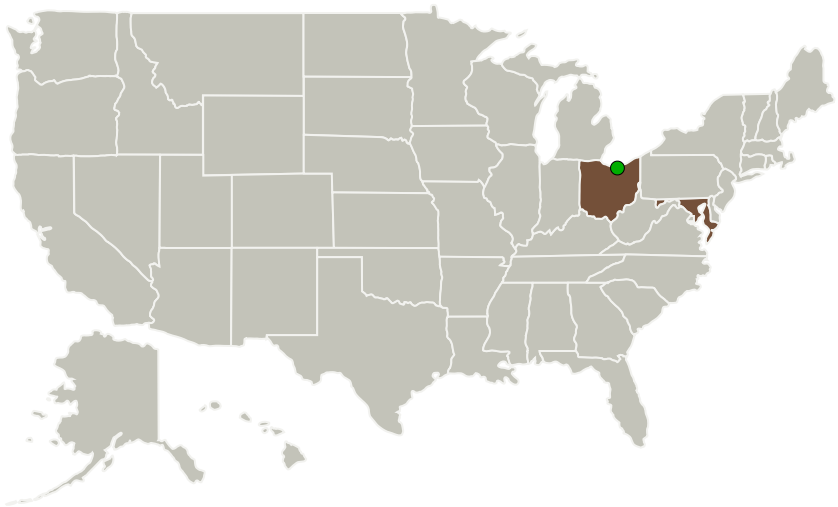
Second-Order Kalman Filter Using Multi-Complex Step Derivatives, Phase I

Completed Technology Project (2011 - 2011)

Project Introduction

Emergent Space Technologies, Inc. (Emergent) and the Georgia Institute of Technology (Georgia Tech) propose to investigate the navigation performance and computational burden of a second-order Kalman filter that uses a new method of computing second-order derivatives using multi-complex numbers, a multi-dimensional generalization of complex numbers. We will develop a prototype of the filter to be integrated into NASA's Orbit Determination Toolbox (ODTBX) in Phase II. We will also investigate techniques to integrate ODTBX and other NASA software such as Optimal Trajectories by Implicit Simulation (OTIS) with NASA's General Mission Analysis Tool (GMAT). Integration techniques to be investigated include service-oriented architecture (SOA) and the Goddard Mission Services Evolution Center (GMSEC) middleware-based architecture. In Phase I, we will provide NASA with a detailed roadmap for integrating estimation, advanced dynamical theories and other capabilities with GMAT. Finally, we will investigate how GMAT and ODTBX can be incorporated into aerospace engineering curricula and research at Georgia Tech in Phase I and then extend our outreach to other top aerospace engineering universities in Phase II, to help expand the user and developer base for these software packages beyond the NASA civil servants and direct contractors who currently develop and use them.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Emergent Space Technologies, Inc.	Lead Organization	Industry	Greenbelt, Maryland
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Maryland	Ohio

Project Transitions

February 2011: Project Start

August 2011: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138485)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Emergent Space Technologies, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

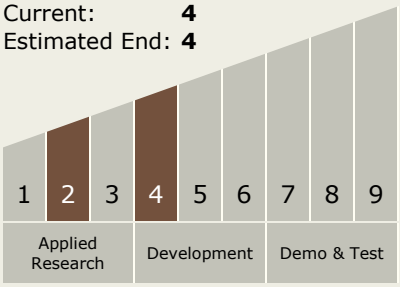
Carlos Torrez

Principal Investigator:

Brendan M O'connor

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX17 Guidance, Navigation, and Control (GN&C)
  - TX17.2 Navigation Technologies
    - TX17.2.3 Navigation Sensors

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System